Radiation, Water Standards, and Uranium Mining/Milling

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Radiation in the Environment

Background Radiation:

- 10- 20 microrem/hour (typical in Virginia), Extremes 5 - 70 microrem/hour
- Annual exposure- 360 millirem/yr
- Man made- medical 300 millirem/yr
- Total- 620 millirem/yr

Radiation Protection Standards

- Non restrictive area- 2 millirem/hr
- Non occupational worker 500 mRem /yr
- Occupational worker 5 rem /yr

Note: 1,000 microrems = 1 millirem

1,000 millirems = 1 rem

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Health Effects of Chronic Exposures to Radiation

Low doses- increase risk of cancer, also genetic effects

- If each person in a group of 10,000 people exposed to 1 rem of ionizing radiation, in small doses over a life time, we would expect 5 or 6 more people to die of cancer than would otherwise.
- In this group of 10,000 people, we can expect about 2,000 to die of cancer from all non-radiation causes. The accumulated exposure to 1 rem of radiation, would increase that number to about 2005 or 2006.
- To give you an idea of the usual rate of exposure, most people receive about 3 tenths of a rem (300 mrem) every year from natural background sources of radiation (mostly radon).

Drinking Water Standards

[Applies to community water supply]

EPA protects to limit fatal cancer risk to 10^{-4} to 10^{-6}, which is equivalent to 4 mrem/yr

Maximum Contaminant Level (MCL)

- Uranium- 30 μg/L chemically toxic to kidneys
- Combined Radium-226 and 228- 5 pCi/L
- Gross alpha 15 pCi/L
- Beta emitters 4mrem/yr
- Radon – no standard

Uranium Mining- methods and risks

Mining operations are regulated by the Office of Surface Mining, the U.S. Department of the Interior, and the individual States where the mines are located [VA Department of Mines, Minerals and Energy].

- Shallow open pit- dust
- Deep shaft mining- dust and radon
- In situ leachate- External exposure to workers from ion exchange resin beds (radium)

Uranium Milling

- Uses chemical processes to extract uranium oxide "yellowcake", 90-95% chemical yield
- Methods-

  Conventional

  In situ leachate

  Heap leaching- No longer exists
- The U.S. Nuclear Regulatory Commission (NRC) regulates conventional milling operations under Title 10, Part 40, of the *Code of Federal Regulations* (10 CFR Part 40), "Domestic Licensing of Source Material."
- Tailings- 40 acre impoundment limit. Radium and Radon

Uranium Mill Tailings

- Congress enacted the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). This Act established two programs to protect the public and the environment from uranium mill tailings.
- The UMTRCA Title I program established a joint Federal/State-funded program for remedial action at abandoned mill tailings sites where tailings resulted largely from production of uranium for the weapons program.
- The UMTRCA Title II program is directed toward uranium mill sites licensed by the NRC or Agreement States in or after 1978. Title II of the Act provides -

  NRC authority to control radiological and non-radiological hazards.

  EPA authority to set generally applicable standards for both radiological and non-radiological hazards.

  Eventual State or Federal ownership of the disposal sites, under general license from NRC.

Questions?

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